



San Diego Unified School District
Science Department

Grade 4 – Solid Earth
Earth Science
Unit of Study



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**Science Vision for
San Diego Unified School District**
Science is an integral part of the intellectual development of a child. Interest in science begins with attitudes and values established in the earliest years through daily experiences. Students graduating from high school must have a foundation in scientific knowledge and evidence based reasoning.

Updated versions of this unit of study can be found online at www.sandi.net/science.



**Grade 4 – Solid Earth
Module Overview**



Overview of the Unit

The Solid Earth Module consists of five sequential investigations, each designed to introduce or reinforce concepts in earth science. The investigations provide students with firsthand experiences with rocks and minerals, and modeling experiences to study changes in rocks and minerals at Earth’s surface.

Grade 4 Earth Science Conceptual Flow

<u>Concept #1</u>			
The properties of rocks and minerals reflect the processes that formed them.			
Subconcepts Investigation #1: Mock Rocks	Subconcepts Investigation #2: Scratch Test	Subconcepts Investigation #3: Calcite Quest	Subconcepts Investigation #4: Take It For Granite
Rocks have many properties, including shape, color, and texture.	A mineral is an earth material that cannot be physically broken down any further.	Rocks are made of minerals.	Rocks are made of ingredients called minerals.
Rocks are made of ingredients called minerals; minerals are made of only one substance.	Hardness, a mineral property, is the resistance of a mineral to being scratched; minerals can be identified and seriated by hardness.	Calcite is one of the most common minerals on Earth.	Minerals can be identified by their properties (e.g. hardness, luster, streak, fizzing in acid).
Mineral crystals have identifiable shapes.		Sometimes more than one test is needed to provide conclusive evidence.	The three basic rock types are igneous, sedimentary, and metamorphic.
		Crystal patterns can help us identify certain minerals.	The rock cycle is a way to describe how the three types of rocks form from one to another.
		Limestone and marble are two rocks that contain calcite.	

Grade 4 Earth Science Conceptual Flow – continued

Concept #2

Waves, wind, water, and ice shape and reshape Earth's land surface.

Subconcepts

Investigation #5: Landforms

Chemical weathering of rocks changes minerals into different minerals.

Physical weathering breaks rocks into smaller particles by physical forces.

Erosion wears away and transports earth materials by water, wind, or ice; deposition relocates eroded earth materials.

Volcanoes, earthquakes, and landslides contribute to rapid changes in landforms.

4th Grade Science Content Standards Addressed in this Module

Earth Sciences

ES4 The properties of rocks and minerals reflect the processes that formed them. As a basis for understanding this concept:

- ES4a Students know how to differentiate among igneous, sedimentary, and metamorphic rocks by referring to their properties and methods of formation (the rock cycle)
- ES4b Students know how to identify common rock-forming minerals (including quartz, calcite, feldspar, mica, and hornblende) and ore minerals by using a table of diagnostic properties.

ES5 Waves, wind, water, and ice shape and reshape Earth's land surface. As a basis for understanding this concept:

- ES5a Students know some changes in the earth are due to slow processes, such as erosion, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.
- ES5b Students know natural processes, including freezing and thawing and the growth of roots, can cause rocks to break down into smaller pieces.
- ES5c Students know moving water erodes landforms, reshaping the land by taking it away from some places and depositing it as pebbles, sand, silt, and mud in other places (weathering, transport, and deposition).

Investigation and Experimentation

I&E6 Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

- I&E6a Differentiate observation from inference (interpretation) and know scientists' explanations come partly from what they observe and partly from how they interpret their observations.
- I&E6b Measure and estimate the weight, length, or volume of objects.
- I&E6c Formulate and justify predictions based on cause-and-effect relationships.
- I&E6d Conduct multiple trials to test a prediction and draw conclusions about the relationships between predictions and results.
- I&E6e Construct and interpret graphs from measurements.
- I&E6f Follow a set of written instructions for a scientific investigation.

Pacing the Unit as a Whole

Administer FOSS Pre-Test				
Day 1 Start Inv. 1 Part 1 A/W	Day 2 R	Day 3 Start Inv. 1 Part 2 A/W	Day 4 R	Day 5 Start Inv. 1 Part 3 A
Day 6 A/W	Day 7 R	Day 8 I-Check 1	Day 9 Review	Day 10 Start Inv. 2 Part 1 A/W
Day 11 R	Day 12 Start Inv. 2 Part 2 A	Day 13 W	Day 14 R	Day 15 R
Day 16 I-Check 2	Day 17 Review	Day 18 Start Inv. 3 Part 1 A/W	Day 19 R	Day 20 Start Inv. 3. Part 2 A
Day 21 A/W	Day 22 R	Day 23 R	Day 24 I-Check 3	Day 25 Review
Day 26 Start Inv. 4 Part 1 A	Day 27 A/W	Day 28 R	Day 29 Start Inv. 4 Part 2 A/W	Day 30 R
Day 31 I-Check 4	Day 32 Review	Day 33 Start Inv. 5. Part 1 A	Day 34 A	Day 35 A
Day 36 A/W	Day 37 R	Day 38 Start Inv. 5. Part 2 A/W	Day 39 Start Inv. 5. Part 3 A/W	Day 40 R
Day 41 Start Inv. 5. Part 4 A	Day 42 A/W	Day 43 R	Day 44 R	Day 45 I-Check 5
Day 46 Start Inv. 5. Part 5 A	Day 47 A	Day 48 Review	Day 49 District Benchmark Assessment	

A – Active Investigation sessions include hands-on work with rocks, minerals, and stream tables, active thinking about the concrete experiences, small-group discussion, writing in science notebooks, learning new vocabulary in context, and completing written embedded assessments to inform instruction. (Approximately 60 minutes)

W – Wrap-up sessions are teacher-directed vocabulary reinforcement and science content review. (Approximately 30 minutes)

R – Reading sessions (*Science Resources* book) include individual and interactive reading, answering review questions, and discussing the reading to ensure that students integrate the information. (Approximately 30 minutes)

I-Checks are short summative assessments. Students respond to written prompts. (Approximately 30 minutes)



Grade 4 – Solid Earth
Pacing Guide – Investigation 1: Mock Rocks



Investigation Overview

Investigation 1: Mock Rocks		
<p>Concept: The properties of rocks and minerals reflect the processes that formed them.</p> <p>Students record observations of mock rocks. They take the rocks apart and sort ingredients. They place some rock material in water, evaporate the liquid, and identify the crystals that form. Students learn that rocks are made of minerals.</p>		
Part 1: Observing Mock Rocks	Part 2: Taking Rocks Apart	Part 3: Observing Crystals
<p><u>Summary</u> Students make and record observations of imitation rocks. They compare the properties of mock rocks with real rocks. Students choose appropriate measuring tools to determine the diameter, circumference, depth, and mass of rocks. Students read an article that introduces rocks and the work done by geologists.</p>	<p><u>Summary</u> Students use a nail as a geologist’s pick to break a mock rock apart. The ingredients are introduced as minerals. Not all ingredients can be separated this way, so students use water to facilitate further separation. Students shake vials containing water and earth materials and observe them before and after settling. Students read an article about mock rocks. They revisit the concept of mineral and think about how mock rocks are similar to and different from real rocks.</p>	<p><u>Summary</u> Students observe the separation that occurs when the ingredients in the vial settle overnight. They pour the liquid out to evaporate. After the water evaporates, students find crystals in the evaporation dishes. They use a crystal-shape table to determine that they are salt-crystals. Students read a summary article discussing minerals, mineral properties, mineral identification, and the differences between mock rocks and real rocks.</p>
<p><u>Subconcepts</u></p> <ul style="list-style-type: none"> ▪ Rocks have many properties, including shape, color, and texture. ▪ Geologists use rock properties to help identify different rocks. ▪ Some dimensions of rocks can be measured and compared. 	<p><u>Subconcepts</u></p> <ul style="list-style-type: none"> ▪ Rocks are made of ingredients called minerals; minerals are made of only one substance. ▪ Some ingredients can be identified by breaking rocks apart. ▪ Water can be used to separate ingredients: some break into smaller pieces, and some dissolve. 	<p><u>Subconcepts</u></p> <ul style="list-style-type: none"> ▪ Rocks are made of minerals. ▪ Evaporation is a way to separate liquid and solid ingredients. ▪ Mineral crystals have identifiable shapes.
<p><u>Time Allocation</u> Active Investigation/Wrap Up: 1 day Reading: 1 day</p>	<p><u>Time Allocation</u> Active Investigation/Wrap Up: 1 day Reading: 1 day</p>	<p><u>Time Allocation</u> Active Investigation/Wrap Up: 2 days Reading: 1 day Assessment: 2 days</p>
<p><u>CA Science Standards</u> ES4b, I&E6b</p>	<p><u>CA Science Standards</u> ES4b, I&E6b</p>	<p><u>CA Science Standards</u> ES4b, I&E6a</p>



Grade 4 – Solid Earth
Pacing Guide – Investigation 1: Mock Rocks



Pacing Guide – Investigation 1: Mock Rocks

Day 1		Day 2		Day 3	
Prep	Instruction	Prep	Instruction	Prep	Instruction
<input type="checkbox"/> Read “Science Background” <i>TG p. 6 – 15</i> <input type="checkbox"/> Read “At a Glance” <i>TG p. 50-51</i> <input type="checkbox"/> Read “Background for the Teacher” <i>TG p. 52- 53</i> <input type="checkbox"/> Read “Teaching Children About Geology” <i>TG p. 54-55</i> <input type="checkbox"/> Watch Video demo of Inv. 1, Pt 1 <input type="checkbox"/> Review “Materials” and “Getting Ready” <i>TG p. 56-59</i> <input type="checkbox"/> Administer FOSS Grade 4 Earth Science Benchmark <i>TG p. 397-402</i>	Guiding the Investigation <input type="checkbox"/> “Part 1: Observing Mock Rocks; Wrapping Up Part 1” Steps 1-12 <i>TG p. 60-63</i>		Reading in Science Resources <input type="checkbox"/> Steps 13-14 <i>TG p. 64</i> Student Reading: Science Resources p. 179-181	<input type="checkbox"/> Watch Video demo of Inv. 1, Pt 2 <input type="checkbox"/> Review “Materials” and “Getting Ready” <i>TG p. 65-67</i>	Guiding the Investigation <input type="checkbox"/> “Part 2: Taking Rocks Apart” Wrapping up Part 2” Steps 1-16 <i>TG p. 68-72</i>

Note: Mock Rocks must be made as part of the preparation for this investigation.

Pacing Guide – Investigation 1: Mock Rocks (continued)

Day 4		Day 5		Day 6	
Prep	Instruction	Prep	Instruction	Prep	Instruction
	Reading in Science Resources <input type="checkbox"/> Steps 17-19 <i>TG p. 73</i> Student Reading: Science Resources p. 182-185 <input type="checkbox"/> Body of Evidence Prompt #1 <i>TG p. 227 or 257</i>	<input type="checkbox"/> Watch Video demo of Inv. 1, Pt 3 Review “Materials” and “Getting Ready” <i>TG p. 74-75</i>	Guiding the Investigation <input type="checkbox"/> “Part 3: Observing Crystals” Steps 1-6 <i>TG p. 76-77</i>		Guiding the Investigation <input type="checkbox"/> “Part 3: Observing Crystals; Wrapping Up Part 3” Steps 7-16 <i>TG p. 77-80</i>
Day 7		Day 8		Day 9	
	Instruction	Prep	Instruction	Prep	Instruction
	Reading in Science Resources; Concluding Investigation 1 <input type="checkbox"/> Steps 17 - 18 <i>TG p. 81</i>		Concluding Investigation 1 <input type="checkbox"/> I-Check 1 Step 19 <i>TG p. 81, 372-375, 403-404</i>		<input type="checkbox"/> Review <input type="checkbox"/> Interdisciplinary Extensions <i>TG p. 82-83</i> <input type="checkbox"/> Body of Evidence Prompt #2 <i>TG p. 301</i>



Grade 4 – Solid Earth
Pacing Guide – Investigation 2: Scratch Test



Investigation Overview

Investigation 2: Scratch Test

Concept: The properties of rocks and minerals reflect the processes that formed them.

Students investigate four unknown minerals and use the property of hardness to make confident identifications of the rock-forming minerals. Students learn one important diagnostic property of minerals.

Part 1: Observing Minerals	Part 2: Testing for Hardness	
<p><u>Summary</u> Students investigate four unknown minerals. They record observations and find that they need more information to make confident identification of the minerals. Easily visible properties aren't enough. Students read about several ores – rocks, and minerals that are mined for various uses, including gold ore (gold and quartz), aluminum ore (bauxite), iron ore (hematite), and copper ore (malachite).</p>	<p><u>Summary</u> Hardness is introduced as a property that can help geologists identify a mineral. Students use paper clips, aluminum nails, and their fingernails to perform scratch tests, compare hardness, and identify minerals (calcite, fluorite, quartz, and gypsum). Students read about Mohs hardness scale and how it is used to rank mineral hardness. They also read about the properties of birthstones (gems), minerals at the top of the scale.</p>	
<p><u>Subconcepts</u></p> <ul style="list-style-type: none"> ▪ A mineral is a basic earth material that cannot be physically broken down any further. ▪ Minerals are the ingredients that make up rocks. ▪ It is usually necessary to know several properties of a mineral in order to identify it. 	<p><u>Subconcepts</u></p> <ul style="list-style-type: none"> ▪ Hardness, a mineral property, is the resistance of a mineral to being scratched. ▪ Minerals can be identified and seriated by hardness. ▪ When comparing the hardness of any two objects, the harder one will scratch the softer one. 	
<p><u>Time Allocation</u> Active Investigation/Wrap Up: 1 day Reading: 1 day</p>	<p><u>Time Allocation</u> Active Investigation/Wrap up: 2 days Reading: 2 days Assessment: 2 days</p>	
<p><u>CA Science Standards</u> ES4b</p>	<p><u>CA Science Standards</u> ES4b, I&E6f</p>	



Grade 4 – Solid Earth
Pacing Guide – Investigation 2: Scratch Test



Pacing Guide – Investigation 2: Scratch Test

Day 10		Day 11		Day 12	
Prep	Instruction	Prep	Instruction	Prep	Instruction
<input type="checkbox"/> Read “At a Glance” <i>TG p. 86-87</i> <input type="checkbox"/> Read “Background for the Teacher” <i>TG p. 88-89</i> <input type="checkbox"/> Read “Teaching Children About Mineral Hardness” <i>TG p. 90-91</i> <input type="checkbox"/> Watch Video demo of Inv. 2, Pt 1 <input type="checkbox"/> Review “Materials” and “Getting Ready” <i>TG p. 92-93</i>	Guiding the Investigation <input type="checkbox"/> “Part 1: Observing Minerals” Steps 1-11 <i>TG p. 94-96</i> <input type="checkbox"/> Body of Evidence Prompt #3 <i>TG p.229 or 259</i>		Reading in Science Resources <input type="checkbox"/> Steps 12-13 <i>TG p. 97</i> Student Reading: Science Resources p. 190-194	<input type="checkbox"/> Watch Video demo of Inv. 2, Pt 2 <input type="checkbox"/> Review “Materials” and “Getting Ready” <i>TG p. 100-101</i>	Guiding the Investigation <input type="checkbox"/> “Part 2: Testing For Hardness” Steps 1-14 <i>TG p. 102-105</i>
Day 13		Day 14		Day 15	
Prep	Instruction	Prep	Instruction	Prep	Instruction
	Guiding the Investigation <input type="checkbox"/> “Part 2: Testing For Hardness; Wrapping Up Part 2” Steps 15-16 <i>TG p. 106</i>		Reading in Science Resources <input type="checkbox"/> Steps 17-18 <i>TG p. 107</i> Student Reading: Science Resources p. 195-198	<input type="checkbox"/> Check <i>Response Sheet – Scratch Test</i> from Step 18	Reading in Science Resources <input type="checkbox"/> Steps 18-21 <i>TG p. 107-108</i> Student Reading: Science Resources p. 199-200

Pacing Guide – Investigation 2: Scratch Test (continued)

Day 16		Day 17	
Prep	Instruction	Prep	Instruction
	Concluding Investigation 2 <input type="checkbox"/> I-Check 2 Step 22 <i>TG p. 108, 376 – 379, 405-406</i>		<input type="checkbox"/> Review <input type="checkbox"/> Interdisciplinary Extensions <i>TG p. 109-110</i>



Grade 4 – Solid Earth
Pacing Guide – Investigation 3: Calcite Quest

Investigation Overview

<p>Investigation 3: Calcite Quest Concept: The properties of rocks and minerals reflect the processes that formed them. Students investigate the mineral calcite and its special property of reacting with vinegar. They place four rock samples in vinegar and look for evidence that calcite is an ingredient. Students are introduced to common sedimentary and metamorphic rocks.</p>		
<p>Part 1: Detecting Calcite</p>	<p>Part 2: Looking For More Evidence</p>	
<p><u>Summary</u> Students investigate one interesting property of the mineral calcite. They place a piece of calcite in vinegar and observe bubbles and fizzing. They place several rock samples in vinegar and look for evidence of calcite as an ingredient. Students read about calcite, its properties, and in which types of rocks and formations contain it.</p>	<p><u>Summary</u> After the rocks sit in vinegar overnight, students pour the liquid into small dishes and let it evaporate. Students find a white needlelike crystal and a powdery white residue in two of the dishes – evidence that calcite is a mineral in some common rocks. Students read about monuments around the world, their history, and the types of rocks they are made of. They are introduced to rock-forming processes.</p>	
<p><u>Subconcepts</u></p> <ul style="list-style-type: none"> ▪ Rocks are made of minerals. ▪ Calcite is one of the most common minerals on Earth. ▪ Putting acid on a rock is a tool geologists use to identify calcite. 	<p><u>Subconcepts</u></p> <ul style="list-style-type: none"> ▪ Sometimes more than one test is needed to provide conclusive evidence. ▪ Evaporation is a technique used to separate liquid from solid parts of a mixture or solution. ▪ Crystal shapes can help us identify certain minerals. ▪ Limestone and marble are two rocks that contain calcite. ▪ There are three basic ways that rocks form. 	
<p><u>Time Allocation</u> Active Investigation/Wrap Up: 1 day Reading: 1 day</p>	<p><u>Time Allocation</u> Active Investigation/Wrap Up: 2 days Reading: 2 days Assessment: 2 days</p>	
<p><u>CA Science Standards</u> ES4b</p>	<p><u>CA Science Standards</u> ES4a, ES4b, I&E6a</p>	



Grade 4 – Solid Earth
Pacing Guide – Investigation 3: Calcite Quest



Pacing Guide – Investigation 3: Calcite Quest

Day 18		Day 19		Day 20	
Prep	Instruction	Prep	Instruction	Prep	Instruction
<input type="checkbox"/> Read “At a Glance” <i>TG p. 112-113</i> <input type="checkbox"/> Read “Background for teacher” <i>TG p. 114-115</i> <input type="checkbox"/> Read “Teaching Children About Rocks and Minerals” <i>TG p. 116-117</i> <input type="checkbox"/> Watch Video demo of Inv. 3, Pt 1 <input type="checkbox"/> Review “Materials” and “Getting Ready” <i>TG p. 118-119</i>	Guiding the Investigation <input type="checkbox"/> “Part 1: Detecting Calcite; Wrapping Up Part 1” Steps 1-15 <i>TG p. 120-123</i> <input type="checkbox"/> Body of Evidence Prompt #4 <i>TG p.232 or 262</i>		Reading in Science Resources <input type="checkbox"/> Steps 16-17 <i>TG p. 124</i> Student Reading: Science Resources p. 202-205	<input type="checkbox"/> Watch Video demo of Inv. 3, Pt 2 <input type="checkbox"/> Review “Materials” and “Getting Ready” <i>TG p. 125-126</i>	Guiding the Investigation <input type="checkbox"/> “Part 2: Looking For More Evidence” Steps 1-7 <i>TG p. 127-128</i>
Day 21		Day 22		Day 23	
Prep	Instruction	Prep	Instruction	Prep	Instruction
<input type="checkbox"/>	Guiding the Investigation <input type="checkbox"/> “Part 2: Looking For More Evidence; Wrapping Up Part 2” Steps 8-18 <i>TG p. 129-132</i>		Reading in Science Resources <input type="checkbox"/> Steps 19-20 <i>TG p. 133</i> <input type="checkbox"/> Student Reading: Science Resources p. 206-210		Concluding Investigation 3 <input type="checkbox"/> Steps 21-22 <i>TG p. 134</i> <input type="checkbox"/> Student Reading: Science Resources p. 211-212

Pacing Guide – Investigation 3: Calcite Quest (continued)

Day 24		Day 25	
Prep	Instruction	Prep	Instruction
	Concluding Investigation 3 <input type="checkbox"/> I-Check 3 Step 23 <i>TG p. 134, 380-383, 407-408</i>		<input type="checkbox"/> Review <input type="checkbox"/> Interdisciplinary Extensions <i>TG p. 109-110</i>



Grade 4 – Solid Earth
Pacing Guide – Investigation 4: Take It For Granite



Investigation Overview

Investigation 4: Take It For Granite		
<p>Concept: The properties of rocks and minerals reflect the processes that formed them. Students investigate more mineral properties – streak and luster – and use a diagnostic table to identify several unknown minerals. Students are introduced to the rock cycle and the processes that form the three types of rocks.</p>		
Part 1: Other Mineral Properties	Part 2: Minerals In Granite	
<p><u>Summary</u> Students investigate the mineral properties of streak and luster. They use color, hardness, streak, luster, and other special properties in a diagnostic table to identify several unknown minerals. Students read about mineral properties and how to use a diagnostic chart to identify minerals.</p>	<p><u>Summary</u> Students sort a set of earth minerals and find that one is rock, granite and the rest are minerals. They test the minerals to identify which ones are in pink granite. Students read about igneous, sedimentary, and metamorphic rocks; how they form; and the rock cycle as a way to describe how rocks change from one form to another.</p>	
<p><u>Subconcepts</u></p> <ul style="list-style-type: none"> ▪ Rocks are made of ingredients called minerals. ▪ Rocks and minerals have identifiable properties. ▪ The minerals that make up a rock can be identified by observing certain properties. 	<p><u>Subconcepts</u></p> <ul style="list-style-type: none"> ▪ Rocks are made of ingredients called minerals. ▪ The minerals that make up a rock can be identified by observing certain properties. ▪ The three basic types of rocks are igneous, sedimentary, and metamorphic. ▪ The rock cycle is a way to describe how the three types of rocks form from one another. 	
<p><u>Time Allocation</u> Active Investigation/Wrap Up: 2 days Reading: 2 days</p>	<p><u>Time Allocation</u> Active Investigation/Wrap Up: 1 day Reading: 2 days Assessment: 2 days</p>	
<p><u>CA Science Standards</u> ES4b</p>	<p><u>CA Science Standards</u> ES4a, ES4b, I&E6a</p>	



Grade 4 – Solid Earth
Pacing Guide – Investigation 4: Take It For Granite

Pacing Guide – Investigation 4: Take It For Granite

Day 26		Day 27		Day 28	
Prep	Instruction	Prep	Instruction	Prep	Instruction
<input type="checkbox"/> Read “At a Glance” <i>TG p. 140-141</i> <input type="checkbox"/> Read “Background for Teacher” <i>TG p. 142-145</i> <input type="checkbox"/> Read “Teaching Children About Changing Rocks and Minerals” <i>TG p. 146-147</i> <input type="checkbox"/> Watch Video demo of Inv. 4, Pt 1 <input type="checkbox"/> Review “Materials” and “Getting Ready” <i>TG p. 148-150</i>	Guiding the Investigation <input type="checkbox"/> “Part 1: Other Mineral Properties” Steps 1-8 <i>TG p. 151-152</i>		Guiding the Investigation <input type="checkbox"/> “Part 1: Other Mineral Properties; Wrapping Up Part 1” Steps 9-19 <i>TG p. 153-155</i> <input type="checkbox"/> Body of Evidence Prompt #5 <i>TG p.237 or 267</i>		Reading in Science Resources <input type="checkbox"/> Steps 20-22 <i>TG p. 156</i> Student Reading: Science Resources p. 214-219

Day 29		Day 30		Day 31	
Prep	Instruction	Prep	Instruction	Prep	Instruction
<input type="checkbox"/> Watch Video demo of Inv. 4, Pt 2 <input type="checkbox"/> Review “Materials” and “Getting Ready” <i>TG p. 157-158</i>	Guiding the Investigation <input type="checkbox"/> “Part 2: Minerals in Granite; Wrapping up Part 2” Steps 1-18 <i>TG p. 159-163</i> <input type="checkbox"/> Body of Evidence Prompt #6 <i>TG p.241 or 271</i>		Reading in Science Resources <input type="checkbox"/> Steps 19-20 <i>TG p. 164</i> Student Reading: Science Resources p. 220-223 <input type="checkbox"/> Body of Evidence Prompt #7 <i>TG p.164; SR 223</i>		Concluding Investigation 4 <input type="checkbox"/> Steps 21-22 <i>TG p. 165</i> Student Reading: Science Resources p. 225-226 <input type="checkbox"/> I-Check 4 Step 23 <i>TG p. 165, 384-387, 409-410</i>
Day 32					
Prep	Instruction				
	<input type="checkbox"/> Review <input type="checkbox"/> Interdisciplinary Extensions <i>TG p. 166-168</i>				



Grade 4 – Solid Earth
Pacing Guide – Investigation 5: Landforms



Investigation Overview

<p>Investigation 5: Landforms Concept: Waves, wind, water, and ice shape and reshape Earth’s land surface. Students investigate chemical weathering by soaking limestone in vinegar, and physical weathering by shaking granite in a jar. They investigate erosion and deposition in a stream table. They learn about processes that cause rapid change to Earth’s surface – earthquakes, volcanism, landslides, and flood.</p>		
Part 1: Weathering	Part 2: Erosion	Part 3: Deposition
<p><u>Summary</u> Students investigate the processes of physical and chemical weathering. They observe what happens to granite pieces that are put in a jar and tumbled over one another. They see that limestone dissolves in a slightly acidic solution of vinegar and water. Students read an article about physical and chemical weathering and some of the interesting landforms that are created by these processes.</p>	<p><u>Summary</u> Students set up stream tables with earth material (a mixture of clay and sand) and a water source. They run a liter of water through the system and focus their observations on the process of erosion. Students become familiar with the vocabulary associated with erosional landforms.</p>	<p><u>Summary</u> Students run the stream tables and focus on deposition – where eroded earth materials are later deposited – and the flow and course of the water. They look closely at how particle size affects the distance a material travels downstream. Students read an article about erosion and deposition, where they happen, and the kinds of landforms they create.</p>
<p><u>Subconcepts</u></p> <ul style="list-style-type: none"> ▪ Weathering is the breaking of rocks into smaller pieces. ▪ Physical weathering is the breaking of rock into smaller particles by physical forces. ▪ Chemical weathering occurs when exposure to water and air changes minerals into something new. 	<p><u>Subconcepts</u></p> <ul style="list-style-type: none"> ▪ A landform is a shape of the earth. ▪ Erosion is the wearing away of earth materials by water, wind, or ice. 	<p><u>Subconcepts</u></p> <ul style="list-style-type: none"> ▪ Deposition is the process by which eroded earth materials settle out in another place. ▪ The flow of water in a stream is affected by barriers in its path. Barriers can be caused by erosion and deposition.
<p><u>Time Allocation</u> Active Investigation/Wrap Up: 4 days Reading: 1 day</p>	<p><u>Time Allocation</u> Active Investigation/Wrap Up: 1 day</p>	<p><u>Time Allocation</u> Active Investigation/Wrap Up: 1 day Reading: 1 day</p>
<p><u>CA Science Standards</u> ES5b, I&E6d, I&E6f</p>	<p><u>CA Science Standards</u> ES5a, ES5c, I&E6f</p>	<p><u>CA Science Standards</u> ES5c, I&E6d</p>

Investigation Overview (continued)

Investigation 5: Landforms

Concept: Waves, wind, water, and ice shape and reshape Earth's land surface.

Students investigate chemical weathering by soaking limestone in vinegar, and physical weathering by shaking granite in a jar. They investigate erosion and deposition in a stream table. They learn about processes that cause rapid change to Earth's surface – earthquakes, volcanism, landslides, and flood.

Part 4: Rapid Changes	Part 5: Investigation and Experimentation	
<p><u>Summary</u> Students predict what effect slope of the land and the volume of water flowing over the land will have on erosion and deposition. They design experiments to test their predictions. After students discover that slope and water volume both accelerate erosion and deposition, they investigate other processes that change landforms rapidly. Students watch a video about volcanoes to learn how volcanism can quickly change landforms. They study a series of captioned photos and learn more about landforms created by weathering, erosion, deposition, eruptions, and crustal movements. Students read about the life and work of geologist, Cynthia Dusel-Bacon.</p>	<p><u>Summary</u> Students continue to experiment with the stream tables by testing the effects of different amounts of flowing water. They record and interpret data.</p>	
<p><u>Subconcepts</u></p> <ul style="list-style-type: none"> ▪ Steeper slopes result in faster-flowing water, which has more energy and can carry larger loads of material, increasing the amount of erosion and deposition. ▪ During a flood, a stream's velocity increases dramatically, increasing erosion and deposition. ▪ Landslides, earthquakes, and volcanoes can produce significant changes in landforms in relatively short periods of time. 	<p><u>Subconcepts</u></p> <ul style="list-style-type: none"> ▪ During a flood, a stream's velocity increases dramatically, increasing erosion and deposition. ▪ Volcanoes, earthquakes, and landslides contribute to rapid changes in Earth's landscape. 	
<p><u>Time Allocation</u> Active Investigation/Wrap Up: 2 days Reading: 2 days Assessment: 1 day</p>	<p><u>Time Allocation</u> Active Investigation/Wrap Up: 2 days Assessment: 2 days</p>	
<p><u>CA Science Standards</u> ES5a, ES5c, I&E6d, I&E6f</p>	<p><u>CA Science Standards</u> I&E6b, I&E6c, I&E6d</p>	



Grade 4 – Solid Earth
Pacing Guide – Investigation 5: Landforms



Pacing Guide – Investigation 5: Landforms

Day 33		Day 34		Day 35	
Prep	Instruction	Prep	Instruction	Prep	Instruction
<input type="checkbox"/> Read “At a Glance” <i>TG p. 170-173</i> <input type="checkbox"/> Read “Background For Teacher” <i>TG p. 174-177</i> <input type="checkbox"/> Read “Teaching Children About Weathering and Erosion” <i>TG p. 178</i> <input type="checkbox"/> Watch Video demo of Inv. 5, Pt 1 <input type="checkbox"/> Review “Materials” and “Getting Ready” <i>TG p. 179-180</i>	Guiding the Investigation <input type="checkbox"/> “Part 1: Weathering” Steps 1-8 <i>TG p. 181-182</i> <input type="checkbox"/> Body of Evidence Prompt #8 <i>TG p.242 or 272</i>		Guiding the Investigation <input type="checkbox"/> “Part 1: Weathering” Steps 9-13 <i>TG p. 183-184</i> <input type="checkbox"/> Body of Evidence Prompt #9 <i>TG p.243 or 273</i>		Guiding the Investigation <input type="checkbox"/> “Part 1: Weathering” Steps 14-18 <i>TG p. 184-186</i>
Day 36		Day 37		Day 38	
Prep	Instruction	Prep	Instruction	Prep	Instruction
	Guiding the Investigation <input type="checkbox"/> “Part 1: Weathering; Wrapping Up Part 1” Steps 19-25 <i>TG p. 186-188,</i> <input type="checkbox"/> Body of Evidence Prompt #10 <i>TG p.244 or 274</i>		Reading in Science Resources <input type="checkbox"/> Steps 26-27 <i>TG p. 189</i> Student Reading: Science Resources p. 228-231	<input type="checkbox"/> Watch Video demo of Inv. 5, Pt 2 <input type="checkbox"/> Review “Materials” and “Getting Ready” <i>TG p. 190-193</i>	Guiding the Investigation “Part 2: Erosion” Steps 1-15 <i>TG p. 194-198</i>

Pacing Guide – Investigation 5: Landforms (continued)

Day 39		Day 40		Day 41	
Prep	Instruction	Prep	Instruction	Prep	Instruction
<input type="checkbox"/> Watch Video demo of Inv. 5, Pt 3 <input type="checkbox"/> Review “Materials” and “Getting Ready” <i>TG p. 199-200</i>	Guiding the Investigation <input type="checkbox"/> “Part 3: Deposition; Wrapping Up Part 3” Steps 1-13 <i>TG p. 201-204</i>		Reading in Science Resources <input type="checkbox"/> Steps 14-15 <i>TG p. 205</i> Student Reading: Science Resources p. 233-239	<input type="checkbox"/> Watch Video demo of Inv. 5, Pt 4 <input type="checkbox"/> Review “Materials” and “Getting Ready” <i>TG p. 206-207</i>	Guiding the Investigation <input type="checkbox"/> “Part 4: Rapid Changes” Steps 1-9 <i>TG p. 208-210</i>
Day 42		Day 43		Day 44	
Prep	Instruction	Prep	Instruction	Prep	Instruction
<input type="checkbox"/> Prepare Video	Guiding the Investigation <input type="checkbox"/> “Part 4: Rapid Changes; Wrapping Up Part 4” Steps 10-16 <i>TG p. 211-213</i> Student Reading: Science Resources p. 240-243		Reading in Science Resources <input type="checkbox"/> Steps 17-19 <i>TG p. 214-215</i> Student Reading: Science Resources p. 244-252		Reading in Science Resources <input type="checkbox"/> Steps 20-21 <i>TG p. 215</i> Student Reading: Science Resources p. 253-257

Pacing Guide – Investigation 5: Landforms (continued)

Day 45		Day 46		Day 47	
Prep	Instruction	Prep	Instruction	Prep	Instruction
	<input type="checkbox"/> I-Check 5 Step 22 <i>TG p. 215, 388-395, 411-414</i>	<input type="checkbox"/> Watch Video demo of Inv. 5, Pt 5 <input type="checkbox"/> Review “Materials” and “Getting Ready” <i>TG p. 216-217</i>	Guiding the Investigation <input type="checkbox"/> “Part 5: Investigation and Experimentation” Steps 1-4 <i>TG p. 218-219, 250, 280, 327</i> <input type="checkbox"/> Body of Evidence Prompt #11 <i>TG p.250-251 or 270-271</i>		Guiding the Investigation <input type="checkbox"/> “Part 5: Investigation and Experimentation” Steps 5-7 <i>TG p. 218-219</i>
Day 48		Day 49			
Prep	Instruction	Prep	Instruction		
	<input type="checkbox"/> Review <input type="checkbox"/> Interdisciplinary Extensions <i>TG p. 166-168</i>		<input type="checkbox"/> Administer DISTRICT Earth Science Benchmark Assessment		



**Grade 4 – Solid Earth
Recommended Body of Evidence**



Overview

This guide is intended to support the collection of a Body of Evidence. A student's Body of Evidence should, at a minimum, include work from the listed prompts and in-class investigations that demonstrate a student's level of proficiency. The FOSS pre-assessment given at the beginning of the unit, the I-checks given after each investigation, and Grade 4 DISTRICT Earth Science Benchmark Assessment given at the end of the unit (post-assessment) may also be included in the body of evidence.

Download samples of proficient work at <https://eteams.sandi.net/sites/sbrc>

Recommended Body of Evidence – Grade 4 Earth Science

Concept #1

The properties of rocks and minerals reflect the processes that formed them.

(CA Standards ES4a, ES4b)

**Prompt 1: FOSS: Solid Earth: Investigation 1: Mock Rocks Part 2: Taking Rocks Apart
(TG p. 227 or 257 – Response Sheet – Mock Rocks – No.5 – Science Notebook)**

Miguel and Emily found a cool rock on the playground. Miguel said, This rock is like the chocolate chip cookie you're eating. Emily disagreed. She said, They don't look alike, and you can't eat a rock! Think about what you know about chocolate chip cookies and what you learned about rocks. What do you think Miguel meant when he said rocks and chocolate chip cookies are alike?

**Prompt 2: FOSS: Solid Earth: Investigation 1: Mock Rocks Home/School Connection
(TG p. 301 – Home/School Connection Investigation 1: Mock Rocks Share A Rock Riddle**

Write your favorite riddle below. Bring the rock and the riddle to school to share with the class.

**Prompt 3: FOSS: Solid Earth: Investigation 2: Scratch Test Part 1: Observing Minerals
(TG p. 229 or 259 – Scratch Test Minerals – No. 7 – Science Notebook)**

List the properties of four minerals.

**Prompt 4: FOSS: Solid Earth: Investigation 3: Calcite Quest Part 1: Detecting Calcite
(TG p. 232 or 262 Calcite-Quest Rocks – No. 10 – Science Notebook)**

Record observations of basalt, limestone, marble, and sandstone.

**Prompt 5: FOSS: Solid Earth: Investigation 4: Take It For Granite Part 1: Other Mineral Properties
(TG p. 237 or 267 – Mineral-Identification Table – No. 15 – Science Notebook)**

Record all the properties you know for four familiar minerals – calcite, quartz, gypsum, and fluorite. Use information in your notebook to help you fill in the table.

Recommended Body of Evidence – Grade 4 Earth Science (continued)

Prompt 6: (I&E) FOSS: Solid Earth: Investigation 4: Take It For Granite Part 2: Minerals In Granite

(TG p. 241 or 271 – Granite Minerals – No 19 – Science Notebook)

Record Observations. Which minerals do you think are in granite? What is your evidence?

Prompt 7: FOSS: Solid Earth: Investigation 4: Take It For Granite Part 2: Minerals in Granite

(Science Resources *Where Do Rocks Come From?* p. 220-223 - TG p. 164)

Answer Review Questions. 1. How do igneous rocks form? 2. How do sedimentary rocks form? 3. How do metamorphic rocks form? 4. Explain how a metamorphic rock could change into a sedimentary rock. 5. What kind of rocks often contain fossils?

Concept #2

Waves, wind, water, and ice shape and reshape Earth's land surface.

(CA Standards ES5a, ES5b, ES5c)

Prompt 8: (I&E) FOSS: Solid Earth: Investigation 5: Landforms Part 1: Weathering

(TG p. 242 or 272 – Weathering Granite – No. 20 – Science Notebook)

Record your observations in the space below. You should include a drawing of a shaken rock and the unshaken rock, as well as some of the smaller pieces. Breaking rocks apart by shaking and bumping is an example of _____.

Prompt 9: (I&E) FOSS: Solid Earth: Investigation 5: Landforms Part 1: Weathering

(TG p. 243 or 273 – Rocks in Acid Rain – No. 21 – Science Notebook)

1. Predict what you will observe when you put limestone in the two cups of acid rain. 2. Put a piece of limestone in each cup. Record your observations.

Prompt 10: (I&E) FOSS: Solid Earth: Investigation 5: Landforms Part 1: Weathering

(TG p. 244 or 274 – Acid-Rain Evaporation – No. 22 – Science Notebook)

1. Compare the 'strong acid-rain' and "weak acid-rain" evaporation dishes. 2. Compare your evaporation dishes to the two control evaporation dishes. 3. Where does the white material in the evaporation dishes come from? 4. Explain what happens when acid rain falls on limestone.

Prompt 11: FOSS: Solid Earth: Investigation 5: Landforms Part 3: Deposition

(Science Resources *Erosion and Deposition* p. 233-239 - TG p. 205)

Answer Review Questions. 1. Describe three ways rock is eroded and three ways rock is deposited. 2. Describe how rocks in the Cascade Mountains become sand on a beach along the California coast. 3. What do you think will happen to the Sierra Nevada in California in the next hundred million years? 4. What is the role of erosion and deposition in the rock cycle?



**Grade 4 – Solid Earth
Module Materials and Equipment**



Materials Provided

The FOSS kit comes with most of the supplies that are needed to teach the unit. The kits will be delivered to the school site prior to the start of the 12-week unit of instruction. At the end of the 12-weeks, the kit will be returned to the Science Resource Center where it will be refurbished and prepared for its next use. Please review the refurbishment calendar for kit drop-off and return dates. Kits must be returned according to the refurbishment calendar to ensure that all kits are checked and restocked with consumable materials.

Materials Supplied by the Teacher or School Site

Be aware that the classroom teacher or school site must supply a few items. These are indicated in the materials list for each part of the investigation with an asterisk (*). Here is a summary of those items.

Investigation 1: Mock Rocks	Investigation 2: Scratch Test	Investigation 3: Calcite Quest	Investigation 4: Take it for Granite	Investigation 5: Landforms
<ul style="list-style-type: none"> ▪ Alum (optional) ▪ Basin or Bucket ▪ Flip Chart ▪ Large magnifying lens (optional) ▪ Marking pen ▪ Colored pencils or pens ▪ 32 safety goggles ▪ Salt 0.5 cup ▪ White flour 1 cup 	<ul style="list-style-type: none"> ▪ 17 pieces of Chalk 	<ul style="list-style-type: none"> ▪ 32 Safety goggles ▪ Paper towels ▪ Vinegar-2 quarts 	<ul style="list-style-type: none"> ▪ 32 Safety goggles ▪ Vinegar, 1 quart 	<ul style="list-style-type: none"> ▪ Bleach 50 ml (optional) ▪ 1 Glass Bottle with tight fitting cap ▪ 1 Clock with second hand ▪ 1 dustpan and broom ▪ Egg cartons, foam styrene ▪ Map of the Western United States or A United States Map ▪ Newspaper ▪ Paper Towels ▪ 2 Pitchers ▪ Sturdy Plastic Bags ▪ 32 Safety Goggles ▪ 1 VCR and Monitor ▪ Vinegar- 1 quart